



Geographic distribution of the genus *Siphlophis* Fitzinger, 1843 (Colubridae, Dipsadinae, Serpentes) in Colombia

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Abstract

Little is known in Colombia about the distribution, ecology, and natural history of the snakes included in the genus *Siphlophis*. Here, based on analysis of specimens deposited in zoological museums and data from literature, we update the information about the geographic distribution of *Siphlophis cervinus* and *Siphlophis compressus* in Colombia.

Key words

Snakes; northern South America; biodiversity lowlands.

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Introduction

The genus *Siphlophis* Fitzinger, 1843 is composed of 7 species of snakes distributed from Costa Rica in Central America to Bolivia and Brazil in South America (Barrio et al. 1998, Uetz et al. 2016). *Siphlophis* is considered a monophyletic group in the family Colubridae (Dipsadinae), nested in the tribe Pseudoboidini with the genus *Clelia* Fitzinger, 1826, *Pseudoboa* Schneider 1801, and *Oxyrhopus* Wagler, 1830 (Pyrón et al. 2011, Uetz et al. 2016). Two species of the genus *Siphlophis* are known in Colombia: *Siphlophis cervinus* Laurenti 1768 and *Siphlophis compressus* Daudin 1803 (Sánchez-C et al. 1994). *Siphlophis cervinus* has been recorded in Peru (Duellman and Salas 1991), Brazil (Frota et al. 2005), Ecuador (Almendariz 1991), Venezuela (Barrio et al. 1998), French Guyana (Gasc and Rodrigues 1980, Chippaux 1986), and Panama (Pérez-Santos 1999); *S. compressus* occurs in Peru (Espinoza and Icochea 1995), Brazil (Barreto et al. 2011), Venezuela (Barrio-Amorós et al. 2010), French

Guyana (Chippaux 1986, Claessen 2005), and Costa Rica (Solorzano 2006).

Pérez-Santos and Moreno (1988) suggested that *S. cervinus* is present in Colombia in the departments of Chocó and Guaviare, while *S. compressus* is present in Amazonas, Boyacá, Cauca, Chocó, Meta, Putumayo, and Valle del Cauca. However, that contribution was strongly criticized because the authors did not associate occurrence data with museum specimens, and the distribution and taxonomic descriptions of some species have several mistakes (Cadle, 1992). Sánchez et al. (1994) suggested that *S. cervinus* is present in the Alto Apaporis and Chocó, while *S. compressus* is present in Amazonas, Orinoco and Pacific coast, but they did not specify departments or localities. Since accurate information about distribution of species is important for understanding their evolutionary history and optimizing management plans when necessary, this paper seeks to update the distribution map of the 2 *Siphlophis* species in Colombia.

Table 1. Locality records for snakes of the genus *Siphlophis* (Colubridae) in Colombia. ANDES-R: Reptile collection, Universidad de los Andes; ICN: Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá DC; IAVH-R: Reptile collection, Instituto de Investigaciones Biológicas Alexander Von Humboldt, Villa de Leyva, Boyacá, Colombia; MHUAN-R: Museo Herpetológico Universidad de Antioquia, Colombia; MLS: Museo la Salle, Universidad de la Salle; UIS-R: Reptile Collection, Universidad Industrial de Santander, Colombia; UTCH:COLZOOCH-H: Colección Científica de Referencia Zoológica del Chocó - Herpetología, Universidad Tecnológica del Chocó. A long dash (—) means that there are no available geographic coordinates.

<i>Siphlophis</i> sp.	Museum code	Locality	Geographic coordinates	
			Latitude	Longitude
<i>S. cervinus</i>	ANDES-R 0306	Antioquia, Yondó	06°42'54" N	074°20'10" W
<i>S. cervinus</i>	IAVH-R 3671	Amazonas, Leticia	04°07' 16" S	069°57'18" W
<i>S. cervinus</i>	MHUA-R 12369	Antioquia, Yondó	06°43' 40" N	074°18'52" W
<i>S. cervinus</i>	IAVH-R 1967	Chocó, Río Sucio	07°35' 53" N	077°03'48" W
<i>S. cervinus</i>	IAVH-R 3858	Amazonas, Parque Amacayacu	03°39' 07" S	070°31'26" W
<i>S. cervinus</i>	ICN 096	Vaupés, Alto Apaporis	—	—
<i>S. cervinus</i>	ICN 8153	Vaupés, Caparú	01°07' 21" S	069°31'24" W
<i>S. cervinus</i>	ICN 11156	Boyacá, Serranía de las Quinchas	05°49' 29" N	074°19'30" W
<i>S. cervinus</i>	MHUA-R 14934	Antioquia, Necoclí	08°29'23" N	076°49'05" W
<i>S. cervinus</i>	MLS-719	Caquetá, Florencia	01°45'00" N	075°34'59" W
<i>S. cervinus</i>	UTCH:COLZOOCH-H:0338	Chocó, Río Atrato	05°35'00" N	076°38'56" W
<i>S. cervinus</i>	UTCH:COLZOOCH-H: 0595	Chocó, Medio Atrato	06°00'08" N	076°46'42" W
<i>S. cervinus</i>	UIS-R-001804	Santander, Girón	07°03'44" N	073°18'34" W
<i>S. compressus</i>	ICN 11342	Amazonas, Km 11 vía Tarapacá	04°07'16" S	069°57'18" W
<i>S. compressus</i>	ICN 9375	Amazonas, Santa Sofía	04°00'33" S	070°08'01" W
<i>S. compressus</i>	IAVH-R 0143	Antioquia, Saragoza	—	—
<i>S. compressus</i>	IAVH-R 1030	Amazonas, Parque Amacayacu	—	—
<i>S. compressus</i>	IAVH-R 2908	Vaupés, Lago Taraira	01°07'21" S	069°31'24" W
<i>S. compressus</i>	IAVH-R 3395	Arauca, Arauca	—	—
<i>S. compressus</i>	IAVH-R 3579	Risaralda, Santa Cecilia	—	—
<i>S. compressus</i>	IAVH-R 4381	Vaupés, Lago Taraira	01°07'21" S	069°31'24" W
<i>S. compressus</i>	IAVH-R 5144	Vichada, Cumarimbo	05°21'20" N	068°01'28" W
<i>S. compressus</i>	IAVH-R 5429	Valle del Cauca, Río Tatauro	—	—
<i>S. compressus</i>	IAVH-R 5767	Boyacá, Cubara	—	—
<i>S. compressus</i>	ICN 0105	Santander, Landázuri	06°19'12" N	073°51'29" W
<i>S. compressus</i>	ICN 1524	Valle del Cauca, Río Saija	02°49'24" N	077°32'54" W
<i>S. compressus</i>	ICN 7267	Meta, Cubarral	—	—
<i>S. compressus</i>	ICN 7911	Boyacá, Puerto Boyacá	—	—
<i>S. compressus</i>	ICN 7999	Guainía, Puerto Inirida	03°37'42" N	067°53'02" W
<i>S. compressus</i>	ICN 8172	Vaupés, Caparú	01°07'21" S	069°31'24" W
<i>S. compressus</i>	ICN 8173	Boyacá, Serranía de las Quinchas	05°49'29" N	074°19'30" W
<i>S. compressus</i>	ICN 8375	Guainía, Puerto Inirida	03°51'59" N	067°55'54" W
<i>S. compressus</i>	ICN 9022	Putumayo, Mocoa	01°05'58" N	076°34'06" W
<i>S. compressus</i>	ICN 10525	Caquetá, Solano, Puerto Abeja	—	—
<i>S. compressus</i>	ICN 10545	Amazonas, Leticia	04°01'24" S	070°06'58" W
<i>S. compressus</i>	ICN 12021	Casanare, San Luis de Palenque	—	—
<i>S. compressus</i>	ICN 12025	—	—	—
<i>S. compressus</i>	ICN 14915	Meta, Puerto López	04°04'00" N	072°52'00" W
<i>S. compressus</i>	MHUAN-R 14733	Antioquia, San Carlos	06°10'26" N	074°45'05" W
<i>S. compressus</i>	MLS-722	Boyacá, Macanal	04°55'00" N	073°15'00" W
<i>S. compressus</i>	UTCH:COLZOOCH-H:0791	Chocó, Nuquí	05°50'36" N	077°16'38" W

Methods

Our update of the distribution of *Siphlophis* is based on the revision of catalogued specimens in 5 zoological museums in Colombia (Reptile collection of Universidad de los Andes, Bogotá; reptile collection of Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá; Instituto Alexander Von Humboldt, Claustro San Agustín, Villa de Leyva; reptile collection of Museo Herpetológico Universidad de Antioquia, Medellín; and Museo la Salle, Universidad de la Salle, Bogotá) (Table 1). The identification of specimens in the Reptile

collection of Escuela de Biología de la Universidad Industrial de Santander (Bucaramanga, Santander) and the Colección Científica de Referencia Zoológica del Chocó, Universidad Tecnológica del Chocó (Quibdó, Chocó), were confirmed by John Douglas Lynch. The distribution maps were made in the Geographical Information System program ArcGIS Online (<https://www.arcgis.com/home/index.html>), using the coordinates obtained from the analysis of specimens in zoological museums.

The taxonomic identification and morphological interspecific comparisons (Tables 2, 3) were made based on literature data (Roze 1966, Peters and Orejas-Miranda



Figure 1. Individuals of *Siphlophis cervinus* (A–C) and *Siphlophis compressus* (D–F) from Colombia. **A, B.** *S. cervinus* from Hacienda San Batolo, Municipality of Yondó, Antioquia, Middle Magdalena river region. **C.** *S. cervinus* from Reserva Tanimboca, Leticia, Amazonas. **D.** *S. compressus* from Santa Sofia, Leticia, Amazonas. **E, F.** *S. compressus* from Reserva Tanimboca, Leticia, Amazonas. Photographs by Fernando Vargas Salinas (A), Juan David Sánchez (B), Andrés Aponte Gutiérrez (C, D), and Goran Mihajlovik (E, F).

1970, Dixon and Soini 1977, Chippaux 1986, Pérez-Santos and Moreno 1988, Barrio et al. 1998), and the advice of John Douglas Lynch. We compared scale accounts of some specimens from different regions in South America, to verify some geographic variation among *Siphlophis* species from Colombia. For *S. cervinus* we collected scale data of specimens from Amazonas: ICN 096, ICN 8153, IAVH-R 3858; Chocó: IAVH-R 1967; and Middle Magdalena Valley: ICN 11156, ANDES-R 0306. For *S. compressus* we collected scale data of specimens from Amazonas: ICN 9022, ICN 10545; Chocó: ICN 1524; Middle Magdalena Valley: IAVH-R 0143; and Orinoquia: ICN 12021, IAVH-R 3395, IAVH-R 5767.

Results

The genus *Siphlophis* is diagnosed by the presence of sulcated maxillary teeth (the third to fifth teeth are the largest), grooved rear fangs, smooth scales, vertebral scales longer than paravertebral scales, subcaudals divided, anal scale entire, and more than one anterior temporal scale (Peters and Orejas-Miranda 1970, Barrio et al. 1998).

Siphlophis cervinus (Laurenti, 1768): Figure 1A–C

Siphlophis cervinus Laurenti 1768: 88; Peters and Orejas-Miranda 1970: 281; Pérez-Santos y Moreno 1988: 311; Barrio et al. 1998: 49–53.

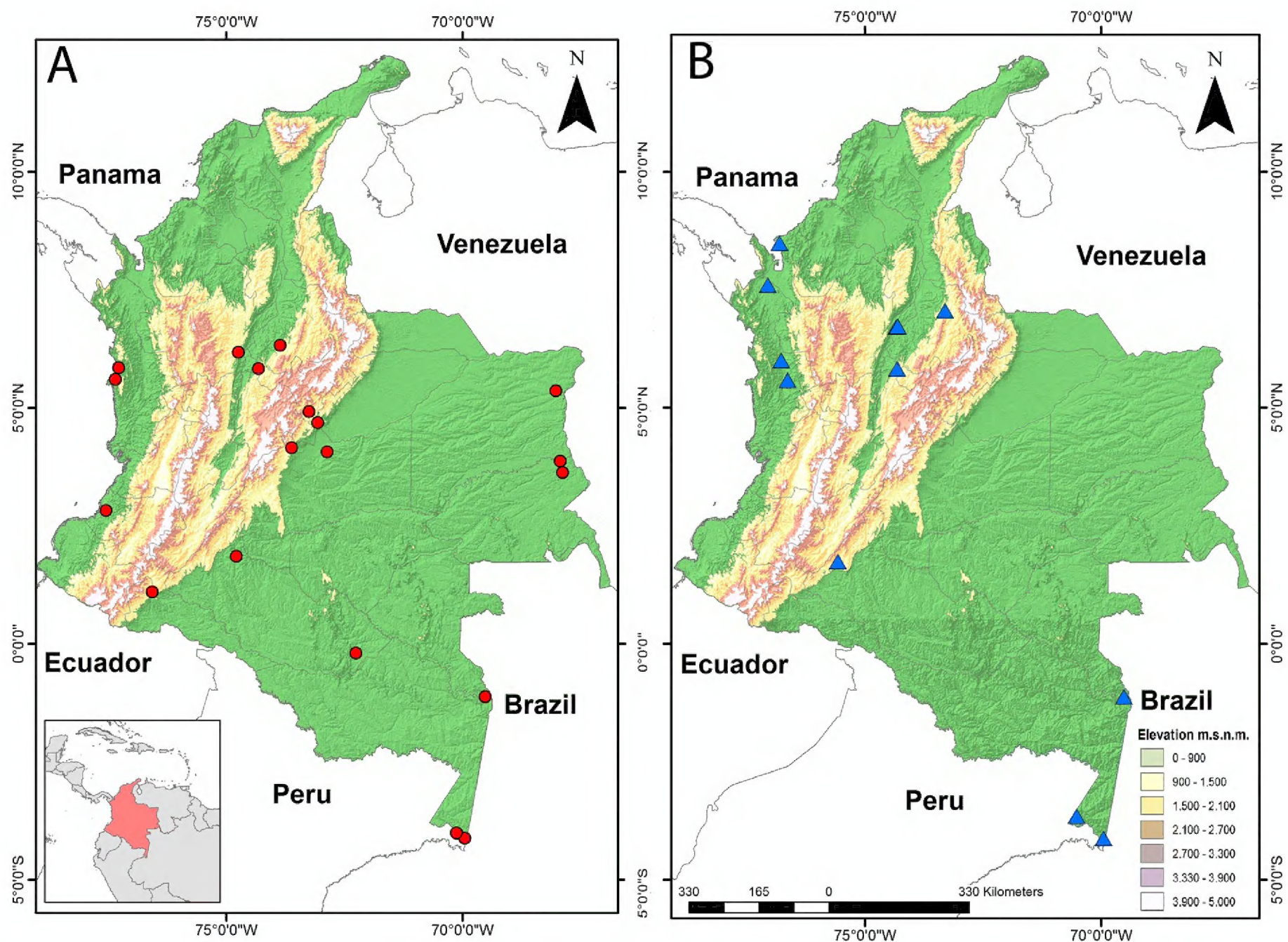


Figure 2. Geographic distribution of two *Siphlophis* species in Colombia. **A.** *Siphlophis compressus* occurrence data (red circles). **B.** *Siphlophis cervinus* occurrence data (blue triangles). See Table 1 for specific data associated to specimens in zoological museums in Colombia.

Lycognathus scolopax Dumeril et al. 1854: 919.

Coronella cervina Laurenti 1768: 88

Material examined. Table 1, Figure 2A

Identification. *Siphlophis cervinus* is recognized by having a body pattern coloration with irregular light and dark markings (between 55 and 103 vertical black and white bars); third upper labial scale entering the orbit; venter with distinct black checks; vertebral region exhibiting red irregular coloration; third to fifth anterior mandibular teeth enlarged and contrasting with other mandibular teeth (Peters and Orejas-Miranda 1970).

Siphlophis compressus (Daudin, 1803): Figures 1D–F

Siphlophis compressus Zaher and Prudente 1999: 700.

Coluber compressus Daudin 1803: 247.

Tripamurgos compressus Peters and Orejas-Miranda 1970: 311.

Material examined. Table 1, Figure 2B

Identification. *Siphlophis compressus* is differentiated from *S. cervinus* because the scales on the vertebral row are distinctly larger than the paravertebral row scales (Peters and Orejas-Miranda 1970), and the color pattern, that presents a dorsum red and black banded (strongly narrow) but the nape band is very wide, and the head is dark reddish-brown to black in some individuals (Dixon and Soini 1977) (Fig. 1A–F).

The analysis of 13 specimens (Table 1) suggests that *S. cervinus* in Colombia lives in lowland and piedmont for-

est cover in the Amazon Basin, the Middle Magdalena Valley and the Choco Basin (Fig. 2B). In addition, based on data this species apparently is more often found in high strata of well-preserved forest. However, is possible to find individuals in forest remnants almost at ground level (ANDES-R 0306, see Table 1). By comparing scale counts among specimens from 3 regions in Colombia (Amazonas, Chocó and Middle Magdalena Valley), we observed that scale counts do not vary much, except for temporals (Table 2).

Based on 28 specimens, the distribution of *S. compressus* in Colombia includes the lowlands and piedmont of the Amazonas, Chocó, Magdalena Medio and Orinoquia regions. However, the specimen MLS 722 indicates that the species may be found in altitudes higher than 1000 m (Fig. 2A). Based on field and museum data, *S. compressus* is found both in preserved and disturbed forests, palm groves (such as Morichales) and mixed palm groves, generally with the presence of water bodies. The available information for this species does not suggest a preference for a specific plant stratum, individuals can be found at ground level or on the canopy. Considering that *S. compressus* has a wider distribution than *S. cervinus*, and based on the scale counts of specimens from 4 different regions (Amazonas, Chocó, Magdalena Medio and Orinoquia), we conclude that *S. compressus* exhibits low variability in scale counts (Table 3).

Table 2. Scales counts in specimens of *Siphlophis cervinus*, Data were obtained in museums and literature. Numbers in parenthesis indicates the supralabial scales entering with the orbit; “with reduction” means that the specimen presents a reduction of dorsal scales to caudal region. A long dash (—) means that was not possible take a count of these scales because the condition of the specimen.

Scales	ICN 096	ICN 8153	ICN 11156	ANDES-R 0306	IAVH-R 3858	IAVH-R 1967	Colombia	Venezuela	Fr. Guiana
							Pérez-Santos & Moreno 1988	Barrio et al. 1998	Chippaux 1986
Rostral	1	1	1	1	1	1	1	1	1
Internasal	2	2	2	2	2	2	2	2	2
Prefrontal	2	2	2	2	2	2	2	2	2
Frontal	1	1	1	1	1	1	1	1	1
Parietal	2	2	2	2	2	2	2	2	2
Supraocular	1	1	1	1	1	1	2	1	1
Nasal	1	1	1	1	1	1	2	2	1
Loreal	1	1	1	1	1	1	1	1	1
Preocular	1	1	1	1	1	1	1	1	1
Postocular	2	2	2	2	2	2	3	2 or 3	2
Temporal	3+4	2+3	1+3+3 & 2+2	2+2+3	1+3+4 & 1+3+2	2+3	1+2	2+3	2+3+4 or 3+3+4
Supralabial	8	8	8	8	9	8	9	8	8
(in contact with orbit)	4–5	4–5	4–5	4–5	4–5	4–5	4–5	4–5	4–5 or 3–4–5
Infralabial	9	9	9	9	10	9	8	8	9 or 10
Dorsals	19*	19*	19 *	19 *	19 *	19 *	19	19 *	19 *
*with reduction									
Ventrals	—	255	—	241	240	258	229	240–252	242–252
Subcaudals	—	116	—	106	106	103	105	108–124	111–124

Table 3. Scales counts in specimens of *Siphlophis compressus*. Data were obtained in museums and literature. Numbers in parenthesis indicates the supralabial scales entering with the orbit; “with reduction” means that the specimen present a reduction of dorsal scales to caudal region. “-” means that was not possible take a count of these scales because the condition of the snake.

Scales	ICN 9022	ICN 10545	ICN 1524	ICN 12021	IAVH-R 5767	IAVH-R 0143	IAVH-R 3395	Colombia	Venezuela	Fr. Guiana
								Pérez-Santos & Moreno 1988	Roze 1966	Chippaux 1986
Rostral	1	1	1	1	1	1	1	1	1	1
Internasal	2	2	2	2	2	2	2	2	2	2
Prefrontal	2	2	2	2	2	2	2	2	2	2
Frontal	1	1	1	1	1	1	1	1	1	1
Parietal	2	2	2	2	2	2	2	2	2	2
Supraocular	1	1	1	1	1	1	1	2	1	1
Nasal	2	2	1	1	2	1	1	2	2	2
Loreal	1	1	1	1	1	1	1	1	1	1
Preocular	1	1	1	1	1	1	1	1	1	1
Postocular	2	2	2	2	2	2	2	2	2	2
Temporal	2+3 & 2+4	2+3	2+3	2+3	2+3	2+3	2+3	2+3	2+3 or 2+2+3	2+3, 4+3 or 4+4
Supralabial	8	8	8	8	8	8	8	8	8	8
(in contact with orbit)	4–5	4–5	4–5	4–5	4–5	4–5	4–5	4–5	4–5	4–5
Infralabial	9	9	9	9	9	9	9	9	9	9
Dorsals	19	19	19	19	19	19	19	19	19	19
*with reduction										
Ventrals	254	249	—	242	252	—	229	228–258	228–258	232–254
Subcaudals	104	121	—	112	122	—	98	110–125	110–125	110–121

Discussion

When our records of *S. cervinus* are compared with those collected by Pérez-Santos and Moreno (1988) and Sánchez et al. (1994), our study extends the species distribution in Colombia to the departments of Amazonas, Antioquia, Boyacá, Caquetá, Santander, and Vaupés. The same comparison for *S. compressus* extends the

species distribution to the departments of Antioquia, Arauca, Caquetá, Guainía, Risaralda, Santander, Vaupés and Vichada. Sánchez et al. (1994) did not mention *S. compressus* from the departments in the Magdalena valley region (i.e. Boyacá, Risaralda, Santander). Summing up, *S. cervinus* and *S. compressus* exhibit wide distributions and predominate in the lowlands and piedmont of Colombia.

For *S. cervinus* we observed that the distribution in Colombia is considered broad, but according to the records obtained from the biological collections, this species does not inhabit the Orinoco basin and Caribbean region. Although this species has been recorded in the Orinoco basin in Venezuela, near Colombia (Barrio et al. 1998), and in the northernmost region of the Orinoco (Flores-Padrón et al. 2016), in both papers the authors stated that individuals were only found in preserved humid forests, in which vegetation cover is similar to Guyanese and Amazonian forests. Therefore, we suppose that *S. cervinus* could be found in similar vegetal coverages on the Colombian Orinoco basin, such as those in the department of Vichada (Rangel-Ch 2014). In addition, Flores-Padrón et al. (2016) found *S. cervinus* at nearly 1000 m above sea level (a.s.l.), which suggests that the species distribution in Colombia can be vertically extended by further data.

S. compressus seems to be widely distributed in Colombia, but it does not inhabit the Caribbean region. This species has been found in lowlands, piedmont and highlands (above 1000 m a.s.l.), which is consistent with the information obtained by Barrio-Amorós et al. (2010).

We observed no geographic pattern in the scale counts for both *S. cervinus* and *S. compressus*. When our data were compared with the literature data from Colombia, Venezuela, and French Guiana (Roze 1966, Chippaux 1986, Pérez-Santos and Moreno 1988, Barrio et al. 1998), we did not observe significant variation in scale counts. Nevertheless, in order to test morphological variation and evolutionary divergence among *Siphlophis* populations, further morphological (e.g. hemipenis, coloration patterns, skeletal, and muscular structures), and ecological data (e.g. diet and habitat preferences) are necessary.

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Authors' Contributions

AAP revised the museum specimens, and AAP and FVS wrote the text.

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